CORRELATION BETWEEN TIMING OF ASV ADMINISTRATION AND COMPLICATIONS IN SNAKE BITES -AN ANALYTICAL STUDY

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CERTIFICATE

This is to certify that this dissertation titled **'CORRELATION BETWEEN TIMING OF ASV ADMINISTRATION AND COMPLICATIONS IN SNAKE BITES- AN ANALYTICAL STUDY'** submitted by **DR.S.THIRUMURUGAN** to the faculty of General Medicine, The Tamil Nadu Dr.M.G.R. Medical University, Chennai in partial fulfillment of the requirement for the award of MD degree Branch I (General Medicine) is a bonafide research work carried out by him under our direct supervision and guidance.

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DECLARATION

I, **Dr.S.THIRUMURUGAN**, solemnly declare that the dissertation titled **'CORRELATION BETWEEN TIMING OF ASV ADMINISTRATION AND COMPLICATIONS IN SNAKE BITES- AN ANALYTICAL STUDY'** has been prepared by me.

This is submitted to the Tamil Nadu Dr.M.G.R. Medical University, Chennai in partial fulfillment of the requirement for the award of MD degree Branch I (General Medicine).

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APPENDIX

1. INTRODUCTION

Snake bites contribute to health problem in India and continue to be a major medical concern. India alone contributes to 81,000 envenomations and 11,000 deaths annually. It appears that every 10 seconds one individual is envenomed and one among four dies due to snake bite. Snake bite is an occupational disease of farmers (rice), plantation workers (rubber, coffee), herdsmen, hunters, snake handlers, fishermen and fish farmers.

In Tamil Nadu the total number of snake bite cases admitted (and expired) in the secondary care hospitals alone during 2005 - 2006 and 2006 -2007 were 19321(85) and 20677(75) respectively. The total number of ASV vials used in these hospitals during the respective periods was 94481 and 96800. Over all analysis revealed that the snakebites and ASV usage in West, North, East, Central, South zone of Tamil Nadu were 13, 17, 20, 24 and 26% respectively.

Snakebites are observed all over the country with a rural / urban ratio of 9:1. They are more common during monsoon and post monsoon seasons. Snakebites are seen often among agricultural workers and among those going to the forest. The male / female ratio among the victims is approximately 3:2. Majority are young and their age is between 25 to 44 years. Most of the bites (90 to 95%) are noticed on the extremities (limbs).

There are more than 3000 species of snakes in the world. For the purpose of clinical practice, snakes are classified into poisonous (venomous) and non-poisonous (nonvenomous) snakes. Poisonous snakes common in India are classified into these families and they are

- **Elapidae** [Cobra group]
- **Viperidae** [Viper group]
- **Hydrophidae** [Sea snake group]

For many decades, the concept of the "Big 4" snakes of medical importance has reflected the view that 4 species and responsible for Indian snakebite mortality. They are the **Indian cobra** (Naja naja), the **Common Krait** (Bungarus caeruleus), the **Russell's viper** (Daboia russelii) and the **Saw scaled viper** (Echis carinatus). However, recently another species, the Hump-nosed pit viper (Hypnale hypnale), has been found to be capable of causing lethal envenomation, and that this problem had been concealed by systematic misidentification of this species as the saw-scaled viper. The concept of the "Big 4" snakes has failed to include all currently known snakes of medical significance in India.

Anti snake venom (ASV):

ASV neutralizes the circulating venom only and no amount of ASV will neutralize or combine with venom once the venom is attached or adsorbed to the target organs. Currently available ASV in India is polyvalent i.e., it is effective against all the four common species; Russells Viper (*Daboia russelii*), Common Cobra (*Naja naja*), Common Krait (*Bungarus caeruleus*) and Saw Scaled Viper (*Echis carinatus*). Indian ASV is a F(ab)2 product derived from horse serum and has a halflife of 26-95 hours. Though it is purified, it still can be immunogenic.

In India ASV is manufactured by **Bengal Chemicals & Pharmaceuticals,** Kolkata; **Bharat Serums,** Mumbai; **Biological Evans,** Hyderabad; **Central Research Institute,** Kausali; **Haffkins Pharmaceuticals,** Mumbai; **King Institute** of preventive medicine, Chennai; **Serum Institute,** Pune and **Vins bio-products**, Hyderabad.

The approximate fatal doses of venom of the poisonous snakes are as follows:

1.Russell's Viper :150mg

2.Saw scaled Viper :80mg

3.Cobra :120mg

4.Krait :60mg

The approximate quantity of venom neutralized by 1ml of polyvalent ASV is given below:

1.Russell's Viper :0.60mg

2.Saw scaled Viper :0.45mg

3.Cobra :0.60mg

4.Krait :0.45mg

ASV can save many of the complications and death due to snake bites if given in time. However superstitions, lack of prompt medical access, late reporting to health care system and cost of ASV delays the administration of ASV. Some authors have postulated that the renal abnormality correlates well with late onset of treatment and that early ASV administration prevents renal damage.

A detailed clinical study correlating the development of complications with timing of ASV administration was needed. Therefore present study was undertaken in inpatients admitted with snake bite in Govt. Rajaji hospital, Madurai to study the use of ASV as an early intervention and to study the relationship of late administration of ASV due to late arrival of patient to the hospital with subsequent development of complications.

2. REVIEW OF THE LITERATURE

2.1 CLASSIFICATION:

There are two important groups (families) of venomous snakes in South-East Asia –**Elapidae** have short permanently erect fangs. This family includes the cobras, king cobra, kraits, coral snakes and the sea snakes. The most important species, from a medical point of view, include the following:

Cobras:	*N naja*	Common spectacled Indian cobra
(Genus Naja)	*N oxiana*	North Indian or Oxus cobra
	N kaouthia	Monocellate cobra
	N philippinensis	Philippine cobra
	N atra	Chinese cobra
Spitting cobras:	*N siamensis*	
	N sumatrana	
	N sputatrix	
King cobra:	*Ophiophagus hannah*	
Kraits:	*B caeruleus*	Common krait
(Genus Bungarus)	*B candidus*	Malayan krait
	B multicinctus	Chinese krait
	B fasciatus	Banded krait

Sea snakes: Important genera include Enhydrina, Lapemis and Hydrophis

Figure 2.1 Common types of Snakes in India

Viperidae have long fangs which are normally folded up against the upper jaw but, when the snake strikes, are erected. There are two subgroups, the **typical vipers (Viperinae) and the pit vipers (Crotalinae)**. The Crotalinae have a special sense organ, the pit organ, to detect their warm-blooded prey. This is situated between the nostril and the eye.

Medically important species in South-East Asia are:

Typical vipers: *Daboia russelii* Russell's vipers

	Echis carinatus	Saw-scaled or carpet vipers
	E sochureki	
Pit vipers:	*Calloselasma rhodostoma*	Malayan pit viper
	Hypnale hypnale	Hump-nosed viper

Green pit vipers or bamboo vipers: (Genus Trimeresurus)

T albolabris	White-lipped green pit viper
T gramineus	Indian bamboo viper
T mucrosquamatus	Chinese habu
T purpureomaculatus	Mangrove pit viper
T stejnegeri	Chinese bamboo viper

2.2 THE VENOM APPARATUS:

Venomous snakes of medical importance have a pair of enlarged teeth, **the fangs**, at the front of their upper jaw. These fangs contain a venom channel (like a hypodermic needle) or groove, along which venom can be introduced deep into the tissues of their natural prey. If a human is bitten, venom is usually injected subcutaneously or intramuscularly.

2.3 IDENTIFICATION OF VENOMOUS SNAKES:

Identification of poisonous snakes is complex (involves counting of scales) and not definitive (the identification of pre or post maxillary teeth) and of no use to a doctor in a medical situation. What is important therefore is to focus on the key aspects of identification that enable the medical professional to rapidly identify whether they are dealing with a venomous species, and what that species might be.

The following features can be used to identify the poisonous snakes:

1. Pupil size: The pupil of harmless snakes is round. Poisonous snakes have elliptical pupils.

2. Pit: Poisonous snakes have a pit, heat sensitive organ situated between the eye and nostril, which detects warm blooded prey. Harmless snakes do not have pits.

Figure 2.2 Venomous Snakes identification

3. Scale arrangements: The underside scales of a venomous snake's tail go all the way across in a single row from anal plate. The very tip of the tail may have two scale rows. Nonpoisonous snakes have two rows of scales from the vent to the end of the tail.

4. Head shape: Venomous snakes have a triangular or spider-shaped head.

5. Distinctive sounds: Russell's viper will produce blowing hiss sound and saw-scaled viper will produce grating rasp sound.

2.4 COMPOSITION OF VENOM:

Snake venoms contain more than 20 different constituents, mainly proteins, including enzymes and polypeptide toxins. The following venom constituents cause important clinical effects:

(i) Procoagulant enzymes (Viperidae) that stimulate blood clotting but result in incoagulable blood. Eventually, and sometimes within 30 minutes of the bite, the levels of clotting factors have been so depleted (consumption coagulopathy) that the blood will not clot. Russell's viper venom affects factors V, X, platelets and protein C while saw-scaled viper venom activates prothrombin and plasminogen.

(ii) Haemorrhagins (Zinc metalloproteinases) that damage the endothelial lining of blood vessel walls causing spontaneous systemic haemorrhage.

(iii) Cytolytic or necrotic toxins - these digestive hydrolases (proteolytic enzymes and phospholipases A), polypeptide toxins and other factors increase permeability resulting in local swelling.

(iv) Haemolytic and myolytic phospholipases A2 - these enzymes damage cell membranes, endothelium, skeletal muscle, nerve and red blood cells.

(v)Pre-synaptic neurotoxins (Krait and Russell's viper) β-bungarotoxin, crotoxin and taipoxin that contain phospholipases A2 that damage nerve endings, initially releasing acetylcholine transmitter, then interfering with release.

(vi) Post-synaptic neurotoxins (Elapidae) - these polypeptides such as α-bungarotoxin and cobratoxin compete with acetylcholine for receptors in the neuromuscular junction and lead to curare-like paralysis.

2.5 QUANTITY OF VENOM INJECTED AT A BITE:

This is very variable, depending on the species and size of the snake, the mechanical efficiency of the bite, whether one or two fangs penetrated the skin and whether there were repeated strikes. The snake may be able to control whether or not venom is injected.

About 50% of bites by Malayan pit vipers and Russell's vipers, 30% of bites by cobras and 5-10% of bites by saw-scaled vipers do not result in any symptoms or signs of envenoming (Dry bites). Snakes do not exhaust their store of venom, even after several strikes, and they are no less venomous after eating their prey. Although large snakes tend to inject more venom than smaller

specimens of the same species, the venom of smaller, younger vipers may be richer in some dangerous components, such as those affecting haemostasis.

2.6 HOW DO SNAKE BITES HAPPEN?

In South-East Asia, snake bite is an occupational hazard of rice farmers; rubber, coffee and other plantation workers; fishermen and those who handle snakes. Most snake bites happen when the snake is trodden on, either in the dark or in undergrowth, by someone who is bare-footed or wearing only sandals. Some bites occur when the snake (usually a krait) comes in to the home at night in search of its prey (other snakes, lizards, frogs, mice) and someone sleeping on the floor rolls over onto the snake in their sleep.

2.7 SYMPTOMS AND SIGNS:

Some people who are bitten by snakes or suspect or imagine that they have been bitten, may develop quite striking symptoms and signs, even when no venom has been injected. This results from fear of the consequences of a real venomous bite. Anxious people may overbreathe so that they develop pins and needles of the extremities, tetany of their hands and feet, dizziness and vasovagal shock. Forcible insufflation of oils into the respiratory tract may lead to aspiration pneumonia, bronchospasm and pneumothorax.

2.7.1 GENERAL SYMPTOMS AND SIGNS OF VIPERINE ENVENOMATION:

Local effects:

- Swelling and local pain with or without erythema
- Tender enlargement of local lymph nodes
- Bruising and local inflammation
- Fang marks

Systemic effects:

- Bleeding from the gingival sulci and other orifices, epistaxis, petechiae, purpura and ecchymoses.

- Renal failure in cases of Russell's viper and sea snake due to acute tubular necrosis secondary to prolonged hypotension, hypovolemia, DIC, direct toxic effect of venom on the renal tubule, hemoglobinuria, myoglobinuria and hyperkalaemia.

- Hypotension resulting from hypovolaemia, direct vasodilation and direct effect on the myocardium, cardiac arrhythmias and pulmonary oedema.

- Muscle pain indicating rhabdomyolysis.

- Parotid swelling, conjunctival oedema, sub-conjunctival haemorrhage.

- Endocrine-acute pituitary/adrenal insufficiency.

2.7.2 GENERAL SYMPTOMS AND SIGNS OF ELAPID ENVENOMATION

Local effects:

- Swelling and local pain with or without erythema (Cobra).
- Local necrosis and / or blistering / bullae (Cobra).

Neurotoxic effects:

- Descending paralysis, initially of muscles innervated by the cranial nerves, commencing with ptosis, diplopia, or ophthalmoplegia. There may be some involvement of the senses of taste and smell.
- Problems of vision, breathing and speech.
- Paralysis of jaw and tongue may lead to upper airway obstruction and aspiration of pooled secretions because of the patient's inability to swallow.
- Numbness around the lips and mouth, progressing to bulbar paralysis and respiratory failure.
- Hypoxia due to inadequate ventilation can cause cyanosis, altered sensoriun and coma.
- Krait bites often present in early morning with paralysis that can be mistaken for a stroke.

Figure-2.3 Cellulitis and blisters

Figure-2.4 Ptosis in neurotoxicity

2.8 LONG TERM COMPLICATIONS (SEQUELAE) OF SNAKE BITE:

At the site of the bite, chronic ulceration, infection, osteomyelitis or arthritis may persist causing severe physical disability. Malignant transformation may occur in skin ulcers after a number of years. Chronic renal failure occurs after bilateral cortical necrosis (Russell's viper bites) and chronic panhypopituitarism or diabetes insipidus after Russell's viper bites. Chronic neurological deficit is seen in the few patients who survive intracranial haemorrhages (Viperidae).

Table 2.1 Snakes, clinical aspects and therapeutic response:

Features	**Cobras**	**Kraits**	**Russell's viper**	**Saw scaled viper**	**Hump nosed viper**
Local Pain /Tissue Damage	Yes	No	Yes	Yes	Yes
Ptosis / Neurological Signs	Yes	Yes	Yes	No	No
Haemostatic abnormalities	No	No	Yes	Yes	Yes
Renal Complications	No	No	Yes	No	Yes
Response to Neostigmine	Yes	No	No	No	No
Response to ASV	Yes	Yes	Yes	Yes	No

2.9 INVESTIGATIONS:

(i) 20 Minutes Whole Blood Clotting Test (20WBCT):

The 20 Minutes Whole Blood Clotting Test (20WBCT) is considered as the most reliable test for coagulation. It is significantly superior to the ‘capillary tube’ method and is the preferred method of choice in snakebite. If the 20WBCT is normal in a suspected case of poisonous snakebites, the test should be carried out every 30 minutes from admission for three hours and then hourly after that. If incoagulable blood is discovered, the 6 hourly cycle will then be adopted to test for the requirement of repeat doses of ASV. This is due to the inability of the liver to replace clotting factors under 6 hrs.

The test is done as follows:

- Place a few mls of freshly sampled venous blood in a small glass vessel
- Leave undisturbed for 20 minutes at ambient temperature
- Tip the vessel once
- If the blood is still liquid (unclotted) and runs out, the patient has hypofibrinogenaemia as a result of venom-induced consumption coagulopathy.
- Warning! If the vessel used for the test is not made of ordinary glass, or if it has been used before and cleaned with detergent, its wall may not stimulate clotting of the blood sample in the usual way and test will be invalid.

(ii) Other Useful Tests:

a) **Haemoglobin concentration/haematocrit:** A transient increase indicates haemoconcentration resulting due to increase in capillary permeability, blood loss or intravascular haemolysis.

b) **Platelet count:** This may be decreased in victims of viper bites.

c) **White blood cell count:** An early neutrophil leucocytosis is present.

d) **Blood film:** Fragmented red cells ("helmet cell", schistocytes) are seen when there is microangiopathic haemolysis.

e) **Plasma/serum** may be pinkish or brownish if there is gross haemoglobinaemia or myoglobinaemia.

f) **Biochemical abnormalities:** Aminotransferases and muscle enzymes (creatine kinase, aldolase etc) will be elevated if there is severe local damage or generalised muscle damage. Bilirubin is elevated following massive extravasation of blood. Creatinine and urea levels are raised in the renal failure. Early hyperkalaemia may be seen following extensive rhabdomyolysis.

g) **Arterial blood gases and pH** may show evidence of respiratory failure and acidaemia (respiratory or metabolic acidosis).

h) **Urine examination:** Microscopy will confirm whether there are erythrocytes in the urine. Red cell casts indicate glomerular bleeding. Massive proteinuria is an early sign of the generalised increase in capillary permeability in Russell's viper envenoming.

2.10 MANAGEMENT OF SNAKE BITE:

2.10.1First aid: 'do it "RIGHT"'

R. = Reassure the patient.

(70% of all snakebites are from non-venomous species. Only 50% of bites by venomous species actually envenomate the patient)

I = Immobilize in the same way as a fractured limb.

(Use bandages or cloth to hold the splints, not to block the blood supply or apply pressure. Do not apply any compression in the form of tight ligatures, they don't work and can be dangerous!)

G. H. = Get to Hospital Immediately.

(Traditional remedies have **NO PROVEN** benefit in treating snakebite).

T= Tell the doctor of any telltale signs and symptoms such as ptosis that manifest on the way to hospital.

2.10.2 Pressure Immobilization Method (PIM):

PIM was developed in Australia in 1974 by Sutherland and gained some supporters on television. Further work done by Howarth demonstrated that the pressure, to be effective, was different in the lower and upper limbs. The upper limb pressure was 40-70mm of Mercury; the lower limb was 55-70mm of mercury. In addition, pressure bandages should not be used where there is a risk of local necrosis that is in 4/5 of the medically significant snakes of India.

In short, pressure-immobilization should be used only in cases where the offending snake is reliably identified and has a primarily neurotoxic venom, the rescuer is skilled in pressure-wrap application, and the victim can be carried to medical care—an uncommon combination of conditions. Initial research has suggested that a **'Pressure Pad or Monash Technique'** may have some benefit in the first aid treatment of snakebite.

2.10.3 Indications for ASV:

ASV treatment is recommended if and when a patient with proven or suspected snake bite develops one or more of the following signs.

Systemic envenomation:

a) Haemostatic abnormalities: spontaneous systemic bleeding, coagulopathy (20WBCT) or thrombocytopenia
b) Neurotoxic signs: ptosis, external ophthalmoplegia, paralysis, etc
c) Cardiovascular abnormalities: hypotension, shock, cardiac arrhythmia and abnormal ECG
d) Acute renal failure: oliguria/anuria and rising blood creatinine/ urea
e) Haemoglobinuria/myoglobinuria: dark brown urine, urine dipsticks, other evidence of intravascular haemolysis or generalised rhabdomyolysis
f) Supporting laboratory evidence of systemic envenomation

Local envenomation:

a) Local swelling involving more than half of the bitten limb (in the absence of a tourniquet) and swelling after bites on the digits (toes and especially fingers)

b) Rapid extension of swelling (for example beyond the wrist or ankle within a few hours of bites on the hands or feet)

c) Development of an enlarged tender lymph node draining the bitten limb

ASV treatment should be given as soon as it is indicated. It may reverse systemic envenoming even when this has persisted for several days or, in the case of haemostatic abnormalities, for two or more weeks. However, when there are signs of local envenoming, without systemic envenoming, ASV will be effective only if it can be given within the first few hours after the bite (WHO guidelines).

2.10.4 Precautions before ASV:

There is no absolute contraindication to ASV. In the absence of any prophylactic regimen that has proved effective in clinical trials, the high risk patients with strong history of atopic diseases may be pre-treated empirically with subcutaneous adrenaline (0.25mg of 0.1%), intravenous antihistamines (both anti-H1, such as promethazine; and anti- H2, such as ranitidine) and corticosteroid. In asthmatic patients, prophylactic use of an inhaled adrenergic β2 agonist such as salbutamol may prevent bronchospasm.

2.10.5 Administration of ASV:

Two methods of administration are recommended:

(1) ***Intravenous "push" injection*****:** Reconstituted freeze-dried antivenom or liquid antivenom is given by slow intravenous injection (not more than 2 ml/minute).

(2) ***Intravenous infusion*****:** Reconstituted freeze-dried or liquid antivenom is diluted in approximately 5-10 ml of isotonic fluid per kg body weight (ie 250-500 ml of isotonic saline or 5% dextrose in case of adults) and is infused at a constant rate over a period of about one hour.

Local administration of ASV at the site of the bite is not recommended as it is extremely painful, may increase intracompartmental pressure and has not been effective. Intramuscular injection of ASV reach blood very slowly. Other disadvantages are the pain and haematoma formation. ASV must never be given by the intramuscular route if it could be given intravenously.

Situations in which intramuscular administration might be considered:

(i) At a peripheral first aid station, before a patient with obvious envenomation is put in an ambulance for a journey to hospital that may last several hours

(ii) On an expedition exploring a remote area very far from medical care

(iii) When intravenous access has proved impossible

Under these unusual circumstances, the dose of ASV should be divided between a number of sites in the upper anterolateral region of both thighs. A

maximum of 5-10 ml should be given at each site by deep intramuscular injection followed by massage to aid absorption.

ASV should never be injected into the gluteal region (upper outer quadrant of the buttock) as absorption is exceptionally slow and unreliable and there is always the danger of sciatic nerve damage when the injection is given by an inexperienced operator.

2.10.6 Dose of antivenom:

Snakes inject the same dose of venom into children and adults. Children must therefore be given exactly the same dose of ASV as adults. In practice, the ***choice of an initial dose of ASV is usually empirical***. For neurotoxic / anti haemostatic envenomation, **8 to 10 vials of ASV** is recommended to be administered as initial dose.

Repeat Doses of ASV:

If on reassessment after 1 - 2hrs the initial dose has been unsuccessful in reducing the symptoms / if the symptoms have worsened / if the patient has gone into respiratory failure then a further dose should be administered. This dose should be the **same as the initial dose**, and then ASV is discontinued. **20 vials is the maximum dose of ASV** that should be given to a neurotoxically envenomed patient. Once a patient in respiratory failure, has received 20 vials of ASV and is supported on a ventilator, ASV therapy should be stopped.

In the case of anti haemostatic envenomation, the ASV strategy will be based around a six hour time period. After the initial ASV, no additional ASV

will be given until the next clotting test is carried out. This is due to the inability of the liver to replace clotting factors within 6 hours. After 6 hours a further coagulation test should be performed and a further dose should be administered in the event of abnormal test. Clotting tests and repeat doses of ASV should continue on a 6 hourly pattern until coagulation is restored. The repeat dose should be **5 -10 vials of ASV** i.e., half to one full dose of the original amount. The most logical approach is to administer the same dose again, as was administered initially.

The normal guidelines are to administer ASV every 6 hours until coagulation has been restored. However, what should the clinician do after say, 30 vials have been administered and the coagulation abnormality persists? At this point the clinician should consider whether the continued administration of ASV is serving any purpose, particularly in the absence of proven systemic bleeding. At this stage the use of Fresh Frozen Plasma (FFP), cryoprecipitate (fibrinogen, factor VIII) fresh whole blood, thrombocytes or coagulation factors can be considered, if available.

2.10.7 ASV reactions:

A proportion of patients, usually more than 20%, develop a reaction either early (within a few hours) or late (5 days or more) after being given ASV.

***A) Early anaphylactic reactions*:** Usually within 10-180 minutes of starting ASV, the patient begins to itch and develops urticaria, dry cough, fever, nausea, vomiting, abdominal colic, diarrhoea and tachycardia. A minority of these patients develop severe life-threatening anaphylaxis: hypotension, bronchospasm and angio-oedema. These reactions are not truly "allergic". They are not IgE-mediated but by complement activation or direct stimulation of mast cells or basophils by antivenom protein are more likely mechanisms.

b) Pyrogenic (endotoxin) reactions: Usually develop 1-2 hours after treatment. Symptoms include shaking chills (rigors), fever, vasodilatation and a fall in blood pressure. These reactions are caused by pyrogen contamination during the manufacturing process.

c) Late (serum sickness type) reactions: develop 1-12 (mean 7) days after treatment. Clinical features include fever, nausea, vomiting, diarrhoea, itching, recurrent urticaria, arthralgia, myalgia, lymphadenopathy, periarticular swellings, mononeuritis multiplex, proteinuria with immune complex nephritis and rarely encephalopathy.

2.10.8 Treatment for ASV reactions:

(i) Discontinue ASV

(ii) Administer Inj. Adrenaline 0.5ml of 1:1000 IM, (Adults).

(If after 10 to 15 minutes the patient's condition has not improved or is worsening, a second dose of 0.5 ml of Adrenaline IM is given. This can be repeated for a third and final occasion but in the vast majority of reactions 2 doses of Adrenaline will be sufficient).

(iii) Start an adrenaline infusion if the patient remains shocked, (preferably via a central venous line), commencing at 0.25 microgram/kg/minute, and titrating as required to restore blood pressure.

(iv) Antihistamines: Administer both H1 receptor blockers Chlorpheniramine maleate 10 - 20mg as IV / IM and H2 receptor blockers Ranitidine 1mg/kg

(v)Administer Corticosteroids intravenously: Hydrocortisone 2 - 6mg/kg or Dexamethasone 0.1 - 0.4mg/kg.

(vi) Late (serum sickness) reactions usually respond to a 5-day course of oral antihistamine (Chlorpheniramine: adults 2 mg six hourly). Patients who fail to respond in 24-48 hours should be given a 5-day course of prednisolone (adults 5 mg six hourly).

2.10.9 Recovery Phase:

If an adequate dose of ASV has been administered, the following responses may be seen:

a) Spontaneous systemic bleeding such as gum bleeding usually stops within 15 to 30 minutes.

b) Blood coagulability is usually restored in 6 hours (20WBCT).

c) Post synaptic neurotoxic envenoming such as the Cobra may begin to improve as early as 30 minutes after ASV, but can take several hours.

d) Presynaptic neurotoxic envenoming such as the Krait usually takes a considerable time to improve reflecting the need for the body to generate new acetylcholine emitters.

e) Active haemolysis and rhabdomyolysis may cease within a few hours and the urine returns to its normal colour during the course of treatment.

f) In patients with shock, blood pressure may increase after 30 minutes while on treatment.

2.10.10 Recurrence of systemic envenoming:

In patients envenomed by vipers, after an initial response to ASV (cessation of bleeding, restoration of blood coagulability), signs of systemic envenoming may recur within 24-48 hours.

This is attributable to:

(1) Continuing absorption of venom from the "depot" at the site of the bite

(2) A redistribution of venom from the tissues into the vascular space, as the result of ASV treatment.

Criteria for repeating the initial dose of ASV

a) Persistence or recurrence of blood incoagulability after 6 hours or bleeding after 1-2 hr.

b) Deteriorating neurotoxic or cardiovascular signs after 1-2 hr.

2.10.11 Treatment of the complications:

(1) Neurotoxic envenomation and respiratory paralysis:

Assisted ventilation has proved effective. Acetylcholinesterase inhibitors (e.g., edrophonium and neostigmine) may promote neurologic improvement in patients bitten by snakes with postsynaptic neurotoxins.

Anticholinesterase ("Tensilon"/Edrophonium) test:

1. Patients with clear, objective evidence of neurotoxicity after snakebite (e.g., ptosis or inability to maintain upward gaze) should receive a trial of edrophonium (if available) or neostigmine.
   a. Pretreat with atropine: 0.6 mg IV (children, 0.02 mg/kg)
   b. Follow with:

   Edrophonium: 10 mg IV (children, 0.25 mg/kg) or
   Neostigmine: 1.5–2.0 mg IM (children, 0.025–0.08 mg/kg)

2. If objective improvement is evident at 5 min, continue neostigmine at a dose of 0.5 mg (children, 0.01 mg/kg) every 30 min as needed, with continued administration of atropine by continuous infusion of 0.6 mg over 8 h (children, 0.02 mg/kg over 8 h).
3. If edrophonium chloride is not available, any other anticholinesterases (distigmine, pyridostigmine, ambenomium) can be used for this assessment but a longer period of observation will be needed (up to one hour). 4. Maintain vigilance regarding aspiration risk, and secure the airway with endotracheal intubation as needed.

(2) Hypotension and shock:

Ideally, hypotension should be treated with plasma expanders (colloids or crystalloids) with observation of the central venous pressure (jugular venous pressure). Excessive volume replacement may cause pulmonary oedema. In patients with evidence of a generalised increase in capillary permeability, a selective vasoconstrictor such as dopamine may be given by intravenous infusion, preferably into a central vein (starting dose 2.5-5 μg/kg/minute).

In victims of Russell's viper bites in South India, acute pituitary and adrenal insufficiency resulting from haemorrhagic infarction of the anterior

pituitary and adrenals may contribute to shock. Hydrocortisone is effective in these cases.

(3) **Renal failure:**

Most, but not all, patients with acute renal failure are oliguric, defined as a urine output of less than 400 ml/day or less than 20 ml/hour. If the patient is hypovolaemic, indicated by supine or postural hypotension, empty neck veins, sunken eyeballs, loss of skin turgor and dryness of mucosae, proceed as follows:

(a) Establish intravenous access

(b) Insert a urethral catheter

(c) Determine the central venous pressure.

(d) **Fluid challenge:** depending on the initial state of hydration/dehydration, an adult patient can be given two litres of isotonic saline over one hour or, until the jugular venous pressure has risen to 8-10 cm above the sternal angle. The fluid challenge must be stopped immediately if pulmonary oedema develops. If the urine output does not improve, try furosamide challenge.

(f) **Furosamide challenge:** 100 mg of furosamide is injected slowly (4-5 mg/minute). If this does not induce a urine output of 40 ml/hour, give a second dose of furosamide, 200 mg. If urine output does not improve, try mannitol challenge.

(g) **Mannitol challenge:** 200 ml of 20% mannitol may be infused intravenously over 20 minutes but this must not be repeated as there is a danger of inducing

dangerous fluid and electrolyte imbalance. An improvement in urine output to more than 40 ml/hr or more than 1 litre/day is considered satisfactory.

(h) **Conservative management:** If the urine output does not improve, despite these challenges, no further diuretics should be given and fluid intake should be restricted to a total of the previous day's output plus "insensible losses" (500-1000 ml/day). If possible, the patient should be referred to a renal unit.

(i) **Biochemical monitoring:** Serum potassium, urea, creatinine and, if possible, pH, bicarbonate, calcium and phosphate should be monitored frequently.

(j**) Dialysis.**

Prevention of renal damage in patients with myoglobinuria or haemoglobinuria is by

- Correcting hypovolaemia and maintain saline diuresis (if possible)
- Correcting severe acidosis with bicarbonate
- Giving a single infusion of 20% mannitol (200 ml over 20 minutes)

In the diuretic phase of renal failure urine output increases. The patient may become polyuric and volume depleted so that salt and water must be carefully replaced. Hypokalaemia may develop, in which case a diet rich in potassium (fruit and fruit juices) is recommended.

Persisting renal dysfunction:

In India, 20-25% of patients referred to renal units with acute renal failure following Russell's viper bite suffered oliguria for more than 4 weeks suggesting the possibility of bilateral renal cortical necrosis. Patients with patchy cortical necrosis show delayed and partial recovery of renal function but those with diffuse cortical necrosis require regular maintenance dialysis and eventual renal transplantation.

(4) Haemostatic disturbances:

In cases of severe bleeding or imminent urgent surgery, restoration of coagulability and platelet function can be accelerated by giving fresh frozen plasma, cryoprecipitate, fresh whole blood or platelet concentrates. Heparin and antifibrinolytic agents are not effective.

(5) Bacterial infections:

Infection at the time of the bite with organisms from the snake's venom and buccal cavity is common. In this case, a prophylactic course of penicillin (or erythromycin for penicillin-hypersensitive patients) and a single dose of gentamicin, together with a booster dose of tetanus toxoid is recommended. Interference with the wound creates a risk of secondary bacterial infection and justifies the use of broad spectrum antibiotics (eg. amoxicillin or a cephalosporin plus a single dose of gentamicin plus metronidazole).

(6) Compartment syndrome:

The clinical features of a compartmental syndrome are

- Disproportionately severe pain
- Pain on passive stretching of intra compartmental muscles
- Hypoaesthesia of areas of skin supplied by underlying nerves
- Obvious tension and tenderness of the compartment on palpation

Detection of arterial pulses by palpation or doppler ultrasound probes, does not exclude intra compartmental ischaemia. The most reliable test is to measure intra compartmental pressure directly through a cannula introduced into the compartment. Intracompartmental pressures exceeding 40 mmHg (less in children) may carry a risk of ischaemic necrosis. However, fasciotomy should not be contemplated until haemostatic abnormalities have been corrected.

In one study which was conducted by ***Narvencar K., JAPI., 2006 Sep;54:717-9*** showed that incidence of complications was directly proportional to the duration of venom in the blood prior to neutralization by ASV due to late arrival of patient at hospital. The early institution of ASV is beneficial in preventing complications in the systemic envenomation.

In another study by *S. R. Vijet et al.,* ***JIPMER*** concluded that renal abnormality correlated well with the degree of coagulation abnormality when left untreated due to late arrival at the hospital. Early administration of ASV prevents renal damage.

3. AIMS AND OBJECTIVES:

The present study was undertaken to study the relationship between the time of anti-snake venom (ASV) administration due to late arrival of patient at hospital and subsequent development of complications.

4. MATERIAL AND METHODS:

Study design: Analytical study

Place: Department of Medicine, Govt. Rajaji Hospital, Madurai.

Period: 6 months (July- December 2008)

Collaborating departments: Department of Biochemistry

Madurai Medical College

Madurai.

Department of Nephrology

Madurai Medical College

Madurai.

Sample size: 164

Selection of the study subjects: 164 patients admitted with snake bite in the medical wards, Govt. Rajaji Hospital from July to December 2008 formed the study group.

Inclusion criteria:

1. Local signs of envenomation:
    - Swelling and local pain with or without erythema
    - Tender enlargement of local lymph nodes
    - Local inflammation
    - Local necrosis and / or blistering / bullae

2. Haematological signs of envenomation

- Haemostatic abnormalities: spontaneous systemic bleeding, coagulopathy (20WBCT) or thrombocytopenia
- Cardiovascular abnormalities: hypotension, shock, cardiac arrhythmia and abnormal ECG
- Acute renal failure: oliguria/anuria and rising blood creatinine and urea
- Haemoglobinuria/myoglobinuria: dark brown urine, urine dipsticks, other evidence of intravascular haemolysis or generalised rhabdomyolysis

3. Neurological signs of envenomation

- Ptosis, diplopia, dysphagia and dysphonia
- Muscle paralysis/weakness
- Respiratory distress
- Confusion

Exclusion criteria:

1 Persons who did not show any signs of envenomation

2. Patients who had received ASV prior to presenting to our institution

Investigations done:

1) 20 minute Whole Blood Clotting Time (20WBCT)
2) Blood sugar, urea and serum creatinine
3) Urine for albumin, sugar and deposits
4) Complete blood count
5) Liver function tests
6) Ultrasonogram (for selected patients)

Complications noted:

a) Acute renal failure (serum creatinine >1.5 mg/dl or oliguria <400ml/day)
b) Disseminated intravascular coagulation or primary fibrinolysis
c) Compartment syndrome
d) Gangrene of the bitten part
e) Cellulitis/necrosis that needed debridement
f) Shock
g) Sepsis
h) Acute respiratory distress syndrome
i) Neurological paralysis requiring ventilatory support

Treatment used:

i. Anti snake venom (ASV)
ii. Antibiotics
iii. Neostigmine and atropine for neurotoxicity

iv. Wound debridement and fasciotomy

v. Hemodialysis for acute renal failure

vi. Artificial ventilation for respiratory failure

vii. Supportive management

Consent: Informed consent was obtained

Ethical committee approval: Obtained

Financial support: Nil

Conflict of interest: Nil

Statistical tool used: The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using **Epidemiological Information Package (EPI 2008).**

Using this software range, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated. Kruskul Wallis chi-square test was used to test the significance of difference between quantitative variables and Yate's test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

5. RESULTS

In our study, 164 patients were studied. The following results were obtained.

Table-5.1 Age distribution

Age group	Total cases	
	No.	Percentage
Upto 20 yrs	25	15.2
21-30 yrs	39	23.8
31-40 yrs	39	23.8
41-50 yrs	34	20.7
>50 yrs	27	16.5
Total	164	100
Range	13-70 yrs	
Mean	36.7 yrs	
SD	14.2 yrs	

In our study, among the total 164 patients 15.2% of patients (25) were below 20 years of age, 23.8% of patients (39) belonged to 21-30 years of age, 23.8% of patients (39) belonged to 31-40 years of age, 20.7% of patients (34) belonged to 41-50 years of age and 16.5% of patients (27) were in the age group of above 50 years. Most of the patients were in the age group of 21-50 years.

Figure 5.1 Age Distribution

Table-5.2 Sex distribution

Sex	Cases	
	No.	Percentage
Male	104	63.4
Female	60	36.6
Total	164	100

As seen in table-5.2 in our study, of the total 164 patients 63.4% of patients (104) were males and 36.6% of the patients (60) were females. Males were more commonly bitten by snakes.

Table-5.3 Place of the snake bite

Bite place	Cases	
	No.	Percentage
House	40	24.4
Field	124	75.6
Total	164	100

Among the 164 patients of our study, as in the table-5.3, 75.6% of the snake bites (124) occurred in their working fields and 24.4% of the snake bites (40) occurred in their houses. More number of snake bites occurred in the fields.

Figure 5.2 Sex Distribution

Figure 5.3 Place of Snake bite

Table-5.4 Site of the snake bite

Bite site	Cases	
	No.	Percentage
Right upper limb	14	8.5
Right lower limb	68	41.6
Left upper limb	22	13.4
Left lower limb	59	35.9
Others	1	0.6

In our study as in table-5.4, 41.6% of snake bites (68) occurred in right lower limb, 35.9% of the bites (59) occurred in left lower limb, 13.4% of the bites (22) occurred in left upper limb, 8.5% of the bites (14) occurred in right upper limb and one case reported in the forehead.

Table-5.5 Type of presentation

Presentation	**Cases**	
	No.	**Percentage**
Local	149	90.9
Neurological	15	9.1
Total	164	100

Figure 5.4 Site of Snake bite

Figure 5.5 Type of presentation

In this study, 90.9% of the patients (149) presented to the hospital with the local manifestations of envenomation and 9.1% of the patients (15) presented with neurotoxic manifestations.

Table-5.6 Clotting time abnormalities

Clotting time	Cases	
	No.	Percentage
Normal (<20 min)	53	32.3
Abnormal (>20 min)	111	67.7
Total	164	100

Among the 164 patients in this study, 67.7% of the patients (111) presented with prolonged clotting time and 32.3% of the patients (53) presented with normal clotting time.

Figure 5.6 Clotting abnormalities

Table-5.7 Supportive treatment

Supportive treatment	Cases	
	No.	Percentage
Blood transfusion	4	2.4
Dialysis	14	8.5
Fasciotomy	4	2.4
Ventilator support	11	6.7
Nil	131	79.9
Total	164	100

In our study, 8.5% of the patients (14) of the total 164 needed dialysis for the treatment of renal failure. 6.7% of the patients (11) needed ventilator support for respiratory failure, 2.4% of the patients (4) needed blood transfusion and 2.4% of the patients needed fasciotomy for the treatment of the compartment syndrome. Among the 164 patients, 79.9% of the patients (131) recovered spontaneously.

Figure 5.7 Supportive treatment

Table-5.8 Complications

Complications	Cases	
	No.	Percentage
Acute renal failure	38	23.8
Respiratory failure	15	9.1
Cellulitis or necrosis that needed debridement	3	1.8
Total complications	56	34.1
No complications	108	65.9
Total	164	100

As seen in the table-5.8 in our study, 65.9% of the patients (108) recovered well without any complications. In the remaining 34.1% of the patients (56), 23.8% of the patients (38) developed acute renal failure, 9.1% of the patients (15) developed respiratory failure and 1.8% of the patients (3) developed cellulitis or necrosis that needed debridement.

Figure 5.8 Complications

Table-5.9 Bite to needle time

Bite to needle time	Cases	
	No.	Percentage
0-4 hrs	66	40.2
4-8 hrs	63	38.4
8-12 hrs	16	9.8
12-24 hrs	15	9.1
More than 24 hrs	4	2.4
Total	164	100
Range	1-58 hrs	
Mean	7.03 hrs	
SD	8.03 hrs	

The bite to needle time (time between snake bite and administration of ASV) varied between 1 and 58 hours in our study. The bite to needle time was 0-4 hours in 40.2% of the patients (66); 4-8 hours in 38.4% of the patients (63); 8-12 hours in 9.8% of the patients; 12-24 hours in 9.1% of the patients (15) and more than 24 hours in 2.4% patients (4). The mean bite to needle time was 7.03 hours. The standard deviation was 8.03 hours.

Figure 5.9 Bite to Needle time

Table-5.10 Bite to needle time and complications

Bite to needle time	**Complications**							
	Acute renal failure		**Respiratory failure**		**Cellulitis or necrosis that needed debridement**		**Total**	
	No.	**Percent**	**No.**	**Percent**	**No.**	**Percent**	**No.**	**Percent**
0-4 hrs	8	12.1	2	3.0	2	3.0	12	18.2
4-8 hrs	14	22.2	8	12.7	-	-	22	34.9
8-12 hrs	6	37.5	1	6.3	1	6.3	8	50
12-24 hrs	6	40	4	26.7	-	-	10	66.7
>24hrs	4	100	-	-	-	-	4	100
Mean bite to needle time	12.4		8.2		6.1		10.9	

The table-5.10 showed the occurrence of various complications in the relation to the bite to needle time. In the group with bite to needle time of 0-4 hours, 12.1% of the patients (8) had acute renal failure, 3% of the patients (2) had respiratory failure and 3% of the patients (2) had cellulitis that needed debridement.

Figure 5.10 Bite to needle time and complications

In the group with bite to needle time of 4-8 hours, 22.2% of the patients (14) had acute renal failure and 12.7% of the patients (8) had respiratory failure. Among the group with bite to needle time of 8-12 hours, 37.5% of the patients (6) had acute renal failure, 6.3% of the patients (one) had respiratory failure and 6.3% of the patients (one) had cellulitis that needed debridement. In the age group with bite to needle time of 12-24 hours, 40% of the patients had acute renal failure and 26.7% of the patients had respiratory failure. In the group with bite to needle time of more than 24 hours, all patients (100%) had acute renal failure.

Table-5.11 Correlation between bite to needle time and complications

Bite to needle time	**Complications**		**No complications**	
	Total			
	No.	**Percentage**	**No.**	**Percentage**
0-4 hrs	12	18.2	54	81.8
4-8 hrs	22	34.9	41	65.1
8-12 hrs	8	50	8	50
12-24 hrs	10	66.7	5	33.3
>24hrs	4	100	-	-
Mean bite to needle time	10.9		5.0	
SD	12.1		3.4	
'p' value	0.0001 (significant)			

Figure 5.11 Correlation between bite to needle time and complications

In our study the bite to needle time was well correlated with the complications as shown in the table-5.11. In this study among the group with bite to needle time of 0-4 hours, 81.8% of the patients (54) had no complications and 18.2% of the patients (12) had complications.

In the group with bite to needle time of 4-8 hours, 65.1% of the patients (41) had no complications and 34.9% of the patients (22) had complications. Among the group with bite to needle time of 8-12 hours, 50% (8) had complications and 50% (8) had no complications. In the group with bite to needle time of 12-24 hours, 66.7% of the patients (10) had complications and 33.3% of the patients (5) had no complications. In the group with bite to needle time of more than 24 hours, 100% of the patients (4) had complications.

The mean bite to needle time was 10.9 hours in the group with complications and 5 hours in the group without complications. This is statistically significant (‘p’ value -0.0001).

6. DISCUSSION

All the patients with history of snake bite were considered for the study and 164 patients were selected for our study. These patients had undergone various investigations like clotting time (20WBCT), blood sugar, urea, serum creatinine, urine for albumin, sugar and deposits, complete blood count, liver function tests and ultra sonogram (for selected patients). ASV was administered for those patients indicated. The indications were

Systemic envenomation:

a) Haemostatic abnormalities: spontaneous systemic bleeding, coagulopathy (20WBCT) or thrombocytopenia
b) Neurotoxic signs: ptosis, external ophthalmoplegia, paralysis etc
c) Cardiovascular abnormalities: hypotension, shock, cardiac arrhythmia and abnormal ECG
d) Acute renal failure: oliguria/anuria and rising blood creatinine/ urea
e) Haemoglobinuria/myoglobinuria: dark brown urine, urine dipsticks, other evidence of intravascular haemolysis or generalised rhabdomyolysis
f) Supporting laboratory evidence of systemic envenomation

Local envenomation:

a) Local swelling involving more than half of the bitten limb (in the absence of a tourniquet) and swelling after bites on the digits (toes and especially fingers)

b) Rapid extension of swelling (for example beyond the wrist or ankle within a few hours of bites on the hands or feet)

c) Development of an enlarged tender lymph node draining the bitten limb

The presence of any adverse reactions were noted and treated accordingly. Clotting time was repeated every 6 hours for those who presented with hemotoxicity and treated with ASV as indicated in the review of literature. The complications due to the snake bite due to the late arrival and late administration of ASV were noted. The bite to needle time which is the time between the time of snake bite and time of ASV administration were noted and the parameters were analyzed.

In our study, 164 patients were selected for study. In these patients, 63.4% of the patients (104) were males and 36.6% of the patients were females. One study which was conducted by ***Narvencar K., J Assoc Physicians India., 2006 Sep;54:717-9*** showed that 90% of the patients were males as compared to 10% of females among 50 patients of his study. ***Hansdac SG et al*** had found that snake bites were 2.5 times more common in males. ***Meyer WP et al*** found 85% of patients to be males.

The high incidence of snake bites in males is probably due to their lifestyles and occupational exposures as farmers or herdsmen, while most females in our state are usually housewives or office workers, thus less prone for snake bites.

In our study as seen in table-5.1, the incidence of snake bite occurred commonly in the age group of 20-50 years. 16.7% of cases seen in the ages of above 50 years. In the study by ***Narvencar K., J Assoc Physicians India., 2006 Sep;54:717-9*** showed that the maximum number of cases (66%) were in the age group of 11-40 years, while only 8% were above the age of 60 years. This was similar to the observation of ***Thomas G Glass*** who found 74% incidence in the age of 10-70 years while only 2% were above 70 years The high incidence in the age group of 11-40 years is again because of occupational exposure, this being the productive age group.

Among the study population, as seen in the table-5.3, 75.6% of the snake bites occured in their working fields and 24.4% of the snake bites occured in their houses. The high number of snake bites in the fields is related to the working place, agricultural land, the prey base of the snake (that is frogs and rats).The rice fields, which harbour millions of rats attract a lot of snakes. Humans go into the field every morning and come out in the evening, just the time when snakes are active. Thus, the chance of an

encounter between farmer and snake is very high. As more areas are inhabited at the periphery of towns, even there the chances of human / snake interaction increase.

In this study, 41.6% of snake bites occurred in right lower limb, 35.9% of the bites occurred in left lower limb, 13.4% of the bites occurred in left upper limb and 8.5% of the bites occurred in right upper limb. The manual working nature of our people is responsible for the increased number of bites in the lower limbs.

In our study, 90.9% of the patients presented to the hospital with the local manifestations of the envenomation which includes local cellulitis, regional lymphadenitis, local bruises and hematological abnormalities like prolonged clotting time, acute renal failure and coagulopathy and 9.1% of the patients presented with neurotoxic manifestations. 67.7% of the patients presented with prolonged clotting time and 32.3% of the patients presented with normal clotting time.

The complications due to late administration because of late arrival of the patients were noted. The complications noted were acute renal failure (serum creatinine >1.5 mg/dl or oliguria <400ml/day); disseminated intravascular coagulation or primary fibrinolysis; compartment syndrome, gangrene, cellulitis/necrosis that needed debridement; shock; sepsis; acute respiratory distress syndrome; neurological paralysis requiring ventilatory support.

As seen in the table-5.8 in our study, 65.9% of the patients recovered well without any complications. In the remaining 34.1% of the patients (56), 23.8% of the patients (38) developed acute renal failure, 9.1% of the patients (15) developed respiratory failure and 1.8% of the patients (3) developed cellulitis or necrosis that needed debridement. In the study by ***Narvencar K., J Assoc Physicians India., 2006 Sep;54:717-9,*** among the 50 patients, 30 cases recovered well without any complications and 20 cases resulted in complications.

The bite to needle time varied between 1 and 58 hours in our study. The bite to needle time was 0-4 hours in 40.2% of the patients (66); 4-8 hours in 38.4% of the patients (63); 8-12 hours in 9.8% of the patients; 12-24 hours in 9.1% of the patients (15) and more than 24 hours in 2.4% patients (4). In ***Narvencar K., J Assoc Physicians India., 2006 Sep;54:717-9*** study among the 50 patients, 36 patients came to the hospital within 6 hours; seven patients in 6-24 hours; five patients in 1-3 days and two patients came to the hospital after 3 days.

The late arrival of the patients are due to poor knowledge about the snake bite, their belief in the traditional methods such as application of tourniquet, cutting (incision) and suction, washing the wound, snake stone or other methods which are useless and harmful and delay in transporting the patients from the periphery.

In our study among the group with bite to needle time of 0-4 hours, 81.8% of the patients (54) had no complications and 18.2% of the patients (12) had complications. In the group with bite to needle time of 4-8 hours, 65.1% of the patients (41) had no complications and 34.9% of the patients (22) had complications. Among the group with bite to needle time of 8-12 hours, 50% (8) had complications and 50% (8) had no complications. In the group with bite to needle time of 12-24 hours, 66.7% of the patients (10) had complications and 33.3% of the patients (5) had no complications. In the group with bite to needle time of more than 24 hours, all patients (4) had complications. Chi-square test was used to find the significance and that is found to be statistically significant ('p' value -0.0001) in this study.

The study by ***Narvencar K., J Assoc Physicians India., 2006 Sep;54:717*** showed that the incidence of complications was directly proportional to the timing of ASV administration. The late administration resulted in more complications. In his study, the complications were less in the population who presented to the hospital as early as within 6 hours (26 cases were complicated and 10 cases were uncomplicated). Among the seven patients with bite to needle time of 6-24 hours four cases were complicated and three were uncomplicated. In the group with bite to needle time of 1-3 days, 80% of the patients (4) got complications and 20% (one) recovered without any complications. All the patients who presented late with bite to needle time of more than 3 days had for complications (100%).

This finding is similar to the observation made by ***Vijeth SR et al***., ***JIPMER*** that the incidence of complications was directly proportional to the duration of venom in the blood prior to neutralization by ASV. This fact is also proved by ***Ash T et al*** **and** ***Thomas L et al*** who documented a positive correlation between severity of renal failure and increased time interval between bite and ASV administration.

One study by ***K. Sam and M. Khan et al., The Internet Journal of Emergency Medicine., 2009 Vol. 5*** showed that snake bite severity scores were directly proportional to the time elapsed between snake bite instance and hospitalisation time. Those patients who were admitted late had higher number of complications like renal failure (52%), breathing difficulty (42%), cellulitis (40%), abnormal PT and APTT in 42% and 39% of cases respectively. Mortality rate was the highest (16%) and higher morbidity and squeal were observed among patients (18%) who were admitted after 24 hours of envenomation. Majority (64%) of those admitted after 13-18 hours seemed to have moderate severity with life threatening symptoms, while those patients (82%), who were admitted within six hours improved.

The fact that the incidence of complications was directly proportional to the duration of venom in the blood prior to its neutralization by ASV due to late arrival of the patient at hospital, point to the possibility or direct toxicity of the venom on organ systems of the body. Based on the findings of present study, we suggest that the early institution of ASV is beneficial in preventing complications however severe the systemic envenomation. The delay in ASV administration could increase the incidence of complications and morbidity as observed from the present study.

7. CONCLUSION

- The incidence of complications is directly proportional to the duration of venom in the blood prior to neutralization by ASV due to late arrival of patient at hospital.
- The early institution of ASV is beneficial in preventing complications however severe is the systemic envenomation.

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PROFORMA

Correlation between timing of ASV administration and complications of snake bite

Patient's Name: Age: Sex:

IP No : Address:

DOA: DOD:

Presentation:

History of Snake bite on- Date: Time: Site:
Clothing: +/- Time of reaching hospital:
On examination,

Cellulitis/ Regional lymphadenitis/ Ptosis/ Diplopia/ Dysphagia/ Dysphonia/ Muscle paralysis/ Weakness/ Respiratory distress/ Confusion

PR: BP: RR: CVS:
RS: Abdomen: CNS:

Investigations:

CT:

Blood sugar:					Urine albumin:	
Blood urea :					Urine sugar:	
Serum creatinine:					Urine deposits:	

Complete blood count: TC: DC: Hb:
LFT:
Others:

Treatment given:

ASV: vials. (started at)

Total doses of ASV:

Antibiotics:
Others: Fasciotomy/ Dialysis/ Ventilatory support/ Blood transfusion

Complications:

Acute renal failure/ Shock/ Sepsis/ ARDS/ Respiratory failure requiring ventilator support/ DIC/

Compartmental syndrome, gangrene, cellulitis or necrosis that needed debridment

Time of snake bite :

Time of ASV given :

Bite to needle time:

Master chart

S. No	IP No	Age	Sex	Bite site	Bite place	Presentation	Clotting time	Blood sugar	Urea	Creatinine	Initial dose of ASV vials	Total ASV vials	Drugs	Others	Complications	Bite to needle time
1	62750	55	M	RAN	F	L	18 min	90	25	1.2	10	10	AB	Nil	Nil	3
2	63559	34	F	LEL	H	L	>20 min	264	23	0.8	5	5	AB	Nil	Nil	16.3
3	63579	18	F	RFH	H	L	15 min	101	19	0.8	5	5	AB	Nil	Nil	12
4	63480	38	F	LFR	F	L	>20 min	69	17	0.7	8	15	AB	Nil	Nil	2.3
5	63088	45	F	LFR	H	N	13 min	367	24	0.9	10	10	AB	Vent	RF	4.3
6	63526	36	M	RAN	F	L	>20 min	144	46	1.8	8	15	AB	Nil	ARF	4.2
7	64050	55	M	RFT	F	L	>20 min	298	92	3.4	10	15	AB	Nil	ARF	2.3
8	65593	29	F	RFR	F	L	>20 min	192	23	1	10	15	AB	Nil	Nil	9
9	65809	25	M	RFT	F	L	7 min	86	36	1.3	8	8	AB	Nil	Nil	2.5
10	66677	35	M	RFR	H	N	12 min	83	25	0.8	5	15	AB	Vent	RF	5.15
11	66678	47	M	RFT	F	L	>20 min	85	40	1.1	15	20	AB	Blood	Nil	4.25
12	66296	14	M	RFT	F	L	>20 min	60	110	3.8	10	15	AB	Dial	ARF	58
13	67786	22	M	LFT	H	L	4 min	114	18	1	8	8	AB	Nil	Nil	7.45
14	67529	60	F	LFT	F	L	>20 min	118	77	2	10	10	AB	Nil	ARF	10
15	68338	45	M	RHA	H	L	>20 min	101	24	0.9	5	5	AB	Nil	Nil	3.3
16	69317	30	M	RFT	F	L	>20 min	82	29	1	5	5	AB	Nil	Nil	1
17	69093	40	M	LFT	F	L	>20 min	104	28	1	5	5	AB	Nil	Nil	7.3
18	68024	29	F	RFT	H	L	7 min	71	18	0.6	5	10	AB	Nil	Nil	7.15
19	68659	29	F	LFR	F	N	6 min	84	21	0.8	15	15	AB	Nil	Nil	4.3
20	68776	13	M	RFT	H	L	>20 min	130	28	0.9	8	8	AB	Nil	Nil	4.45
21	69545	37	F	RTO	H	N	7 min	92	18	0.6	10	18	AB	Nil	Nil	5.15
22	69343	45	F	RFT	H	N	12 min	60	37	0.9	10	10	AB	Vent	RF	5.3
23	69924	42	F	RFA	F	N	5 min	234	27	1	15	15	AB	Vent	RF	12.3
24	69938	47	M	RFT	F	N	12 min	130	28	0.7	15	15	AB	Nil	RF	7.15
25	70298	30	F	LTO	H	L	12 min	164	18	0.7	5	5	AB	Nil	RF	16.45
26	70219	70	F	RHA	F	L	8 min	102	20	1	5	5	AB	Nil	Nil	3
27	71348	50	F	LFR	H	L	>20 min	63	18	0.7	10	15	AB	Nil	Nil	2.3
28	70269	38	M	RFT	F	L	>20 min	291	30	1.2	10	10	AB	Nil	Nil	2.45
29	71314	30	M	RHA	F	L	13 min	63	20	0.6	13	13	AB	Nil	Nil	2.3
30	71844	58	F	RFT	F	L	>20 min	65	61	2.2	15	15	AB	Nil	ARF	7.45
31	71827	45	M	RLE	H	L	9 min	66	30	0.9	8	8	AB	Nil	ARF	19.3
32	71834	26	M	RFT	F	N	8 min	124	29	0.9	15	15	AB	Nil	Nil	6.15
33	73077	60	M	LLE	H	L	>20 min	65	30	0.7	10	15	AB	Nil	Nil	9
34	73088	28	M	RFT	H	L	>20 min	89	25	0.8	5	5	AB	Nil	Nil	7.3
35	73060	17	M	LLE	H	L	>20 min	65	18	0.7	5	10	AB	Nil	Nil	2

S. No	IP No	Age	Sex	Bite site	Bite place	Presentation	Clotting time	Blood sugar	Urea	Creatinine	Initial dose of ASV vials	Total ASV vials	Drugs	Others	Complications	Bite to needle time
36	73469	45	F	LFT	H	L	>20 min	93	41	1	10	18	AB	Nil	ARF	20.45
37	73537	52	F	RLE	F	L	>20 min	80	24	0.8	5	15	AB	Nil	Nil	3.45
38	73334	22	M	RFT	F	L	10 min	95	21	0.8	8	8	AB	Nil	Nil	2
39	73531	18	M	LFR	F	L	5 min	145	33	0.8	5	5	AB	Nil	Nil	5
40	73570	40	M	LFT	H	L	>20 min	122	33	1.1	10	20	AB	Nil	Nil	3
41	73571	35	M	LEL	F	L	>20 min	147	30	1.1	10	20	AB	Nil	Nil	3
42	73546	15	M	LLE	F	L	5 min	86	24	0.7	5	10	AB	Nil	Nil	5
43	73624	35	F	RTO	F	L	>20 min	60	23	0.7	10	10	AB	Nil	Nil	4
44	74381	68	M	RLE	F	L	>20 min	224	64	1.7	10	10	AB	Nil	ARF	8.3
45	74023	65	M	RFT	F	L	>20 min	166	87	2.5	10	10	AB	Nil	ARF	10.3
46	74087	60	F	LFT	H	L	>20 min	105	35	0.9	10	10	AB	Nil	Nil	4.3
47	74792	40	F	RFT	H	L	8 min	368	42	1.8	5	15	AB	Nil	ARF	41
48	74647	21	M	LLE	H	L	>20 min	147	62	2.3	8	18	AB	Nil	ARF	3
49	74684	57	M	RSH	H	L	>20 min	120	30	1.2	8	15	AB	Nil	Nil	1.1
50	74634	37	M	RFT	F	L	>20 min	107	18	0.9	8	13	AB	Nil	Nil	3
51	72576	45	M	RLE	H	L	14 min	148	69	2.5	3	3	AB	Dial	ARF	57
52	75274	40	F	RLE	F	L	>20 min	209	19	0.8	10	15	AB	Nil	Nil	4
53	75163	17	M	RLE	F	L	>20 min	64	27	0.9	10	15	AB	Nil	Nil	3
54	75064	50	M	LFR	F	L	>20 min	70	69	1.9	8	8	AB	Nil	Nil	8.1
55	75229	14	M	LFT	F	L	>20 min	140	27	1.2	8	8	AB	Nil	Nil	4
56	75391	30	F	RLE	H	L	10 min	94	23	0.8	10	15	AB	Nil	Nil	4.25
57	75916	37	M	RFR	F	L	>20 min	64	23	0.9	10	10	A	Nil	Nil	4.15

													B			
58	75139	40	F	LLE	F	L	>20 min	114	26	0.8	10	25	AB	Nil	Nil	9.1
59	78484	40	M	RLE	H	L	>20 min	109	22	1	10	10	AB	Nil	Nil	3
60	79029	32	F	RAN	F	N	11 min	113	25	0.9	20	28	AB	Vent	RF	14.3
61	78726	45	M	RTH	F	L	9 min	75	18	0.9	5	5	AB	Nil	Nil	3.3
62	78682	51	M	RFT	F	L	>20 min	145	22	0.8	5	5	AB	Nil	Nil	6
63	78759	13	M	RFT	F	L	>20 min	96	70	1	5	5	AB	Nil	RF	5
64	78758	45	M	RLE	F	L	>20 min	92	18	0.7	5	5	AB	Nil	Nil	6.1
65	79007	56	M	RFT	F	L	>20 min	130	38	1	13	13	AB	Nil	Nil	3.45
66	76275	18	F	RLE	F	L	10 min	69	28	0.9	15	15	AB	Nil	Nil	5
67	79292	21	F	LFT	F	L	7 min	65	28	0.9	5	5	AB	Nil	ARF	15.15
68	79457	30	F	RFT	F	L	>20 min	115	23	0.8	10	10	AB	Nil	Nil	3
69	79826	19	F	LFT	F	L	>20 min	91	25	0.8	15	15	AB	Nil	Nil	6
70	79806	22	F	LFT	F	L	10 min	64	18	0.8	10	10	AB	Nil	Nil	5

S. No	**IP No**	**Age**	**Sex**	**Bite site**	**Bite place**	**Presentation**	**Clotting time**	**Blood sugar**	**Urea**	**Creatinine**	**Initial dose of ASV vials**	**Total ASV vials**	**Drugs**	**Others**	**Complications**	**Bite to needle time**
71	80429	52	M	LFT	F	L	>20 min	93	24	0.9	8	8	AB	Nil	Nil	3
72	80199	32	M	RFT	F	L	10 min	70	19	0.8	8	8	AB	Nil	Nil	3.15
73	79336	65	M	LFT	F	L	>20 min	120	32	0.9	15	25	AB	Nil	Nil	2.3
74	79316	18	M	LFT	F	L	10 min	60	42	1	10	20	AB	Nil	ARF	7.4
75	80172	40	M	RFR	H	N	10 min	112	40	0.7	10	10	AB	Vent	RF	8
76	79838	45	M	RLE	F	L	12 min	110	48	1.6	10	10	AB	Nil	ARF	6.3
77	79815	35	M	LHA	F	L	>20 min	73	22	0.9	10	10	AB	Nil	Nil	4.45
78	80173	24	M	RFT	H	L	>20 min	70	43	2	8	13	AB	Nil	ARF	7
79	80124	55	M	LTO	F	L	>20 min	111	53	1.2	10	10	AB	Nil	Nil	8
80	80637	40	M	LFR	F	L	9 min	74	62	0.8	10	10	AB	Nil	Nil	6.45
81	81119	50	F	LLE	H	L	>20 min	86	31	1	15	17	AB	Nil	Nil	3.3
82	80683	65	M	LLE	F	L	7 min	68	30	0.9	5	5	AB	Nil	Nil	20.3

83	80600	36	M	LFT	F	L	>20 min	60	32	1.7	5	10	AB	Nil	Nil	6.3
84	80430	60	F	LAN	H	L	>20 min	84	18	0.8	8	18	AB	Nil	Nil	3.55
85	81076	49	M	RAN	F	L	8 min	65	25	0.9	7	11	AB	Nil	ARF	4.3
86	81732	46	M	LFT	F	L	>20 min	88	30	0.9	5	5	AB	Nil	Nil	14.3
87	82114	40	F	LFR	F	L	8 min	108	23	1	10	10	AB	Nil	Nil	7
88	82374	13	F	LFR	F	L	>20 min	84	14	0.8	10	20	AB	Nil	Nil	5
89	82490	45	F	LFT	H	L	>20 min	91	37	1	10	10	AB	Nil	Nil	4
90	82547	55	M	LFT	F	L	>20 min	88	18	0.8	5	5	AB	Nil	Nil	1.45
91	82544	30	M	LTO	F	L	>20 min	76	18	0.7	5	5	AB	Nil	Nil	10
92	82022	35	M	RFT	F	L	8 min	82	17	0.7	5	5	AB	Nil	Nil	5
93	82287	22	M	RFT	F	L	>20 min	90	79	3	15	15	AB	Nil	Nil	8
94	82254	14	M	LFT	F	L	>20 min	192	20	0.8	15	15	AB	Nil	Nil	2
95	82274	37	F	LFT	H	L	>20 min	70	30	1.5	15	15	AB	Nil	Nil	4
96	81460	50	M	RFR	H	N	10 min	70	18	0.8	15	25	AB	Vent	RF	6.5
97	81409	23	M	RFT	H	L	>20 min	123	71	3.1	10	10	AB	Dial	ARF	4
98	81949	30	M	RTH	F	L	>20 min	254	34	1.8	10	10	AB	Dial	Nil	3.3
99	81989	37	F	LFT	H	L	>20 min	71	39	1.5	15	15	AB	Nil	ARF	6.3
100	82680	20	M	LLE	F	L	>20 min	94	21	0.9	5	5	AB	Nil	Nil	7
101	82261	24	F	LFT	F	L	>20 min	62	16	0.8	8	8	AB	Nil	ARF	7
102	82165	40	F	RFR	F	L	>20 min	91	30	0.7	10	18	AB	Nil	Nil	6
103	84528	28	M	LTO	F	L	5 min	62	43	0.9	5	5	AB	Nil	Nil	5.05
104	84594	42	F	LLE	F	L	>20 min	183	23	0.9	5	10	AB	Nil	Nil	10.5
105	83243	24	F	LHA	F	L	>20 min	62	18	0.8	5	10	AB	Nil	Nil	2.3

S. No	IP No	Age	Sex	Bite site	Bite place	Presentation	Clotting time	Blood sugar	Urea	Creatinine	Initial dose of ASV vials	Total ASV vials	Drugs	Others	Complications	Bite to needle time
106	83232	43	F	LFT	F	L	>20 min	180	16	0.7	15	30	AB	Vent	RF	3.3
107	83031	16	M	RTO	F	L	10 min	115	22	0.7	8	8	AB	Nil	Nil	3.15
108	83291	55	M	RFT	F	L	>20 min	73	19	0.8	10	15	AB	Nil	Nil	13.3
10	83056	15	M	LLE	F	L	>20 min	133	23	0.8	10	10	AB	Nil	Nil	5

9																
110	83031	45	F	RLE	H	N	8 min	188	44	1.1	18	18	AB	Nil	Nil	2.15
111	84387	35	M	LLE	H	L	11 min	78	36	1	10	12	AB	Nil	Nil	3.3
112	84323	13	F	LFT	F	L	10 min	91	39	1.2	8	8	AB	Nil	Nil	6.3
113	84472	40	M	LFT	F	L	>20 min	144	36	1	10	10	AB	Nil	RF	16
114	84620	23	M	LLE	F	L	>20 min	82	32	1.1	10	20	AB	Nil	Nil	4
115	84320	44	F	RFT	F	L	>20 min	108	60	2.2	10	15	AB	Nil	ARF	3.3
116	84945	29	M	RFT	F	L	>20 min	106	39	2.5	18	23	AB	Blood	ARF	9
117	85704	50	M	LEL	F	N	6 min	160	28	0.9	10	40	AB	Vent	RF	9.3
118	85852	54	M	LFT	F	L	>20 min	71	68	1.9	10	10	AB	Nil	Nil	4.5
119	85901	45	M	RFT	F	L	>20 min	124	43	1.5	10	20	AB	Blood	ARF	2.4
120	87377	27	M	LTO	F	L	>20 min	168	22	0.8	15	25	AB	Nil	Nil	3.3
121	86718	46	M	RFT	F	L	>20 min	108	24	0.8	10	15	AB	Nil	Nil	6.3
122	86920	44	M	LHA	F	L	>20 min	89	90	5.9	15	15	AB	Dial	ARF	5
123	87336	33	M	RFT	F	L	10 min	82	18	0.9	5	5	AB	Nil	Nil	2
124	86818	25	F	LHE	F	L	12 min	89	30	0.7	5	10	AB	Nil	Nil	6
125	90307	15	M	LLE	F	L	>20 min	78	30	1	10	10	AB	Nil	Nil	3.1
126	89347	60	F	RAN	F	L	>20 min	84	20	0.9	20	30	AB	Nil	Nil	4.3
127	89237	35	M	RHA	F	L	>20 min	101	20	0.8	10	25	AB	Nil	Nil	16.45
128	90578	45	M	RFT	F	L	>20 min	76	26	0.8	10	18	AB	Nil	Nil	4.3
129	90612	29	M	LLE	F	L	>20 min	115	16	0.6	5	10	AB	Nil	Nil	3.15
130	89110	23	M	LFT	F	L	>20 min	74	56	2.5	10	10	AB	Dial	ARF	3
131	87602	25	F	LAN	F	L	>20 min	100	28	0.9	5	5	AB	Nil	Nil	3
132	87672	20	M	LFT	F	L	>20 min	108	22	0.8	5	5	AB	Nil	Nil	4.15
133	87961	37	F	RTO	F	L	10 min	80	24	0.8	5	5	AB	Nil	Nil	7.45
134	88355	24	F	LLE	H	N	15 min	140	28	0.9	10	10	AB	Vent	RF	3
135	35090	29	M	LLE	F	L	>20 min	157	20	0.8	15	20	AB	Nil	Nil	5.3
136	36673	60	F	LLE	F	L	>20 min	72	42	1	10	10	AB	Fascio	C/N	3
137	36096	25	M	LFT	F	L	>20 min	139	50	1.9	15	20	AB	Fascio	ARF	3.3
138	23252	50	M	LLE	F	L	>20 min	148	28	1	10	25	AB	Fascio	C/N	3.3
139	100189	55	F	LLE	F	L	10 min	105	204	4.3	15	15	AB	Dial	ARF	43
140	99079	49	F	LFR	F	L	>20 min	98	135	3.3	5	10	AB	Nil	ARF	13

S. No	IP No	Age	Sex	Bite site	Bite place	Presentation	Clotting time	Blood sugar	Urea	Creatinine	Initial dose of ASV vials	Total ASV vials	Drugs	Others	Complications	Bite to needle time
141	92113	37	F	LEL	F	L	>20 min	116	125	1.5	10	13	AB	Dial	ARF	19.3
142	93398	56	F	RFT	F	L	>20 min	102	26	0.9	10	20	AB	Blood	Nil	10.3
143	91987	15	M	LFR	H	N	14 min	129	18	0.8	15	30	AB	Vent	RF	6.3
144	92113	37	F	LAR	H	L	>20 min	92	45	2.2	10	13	AB	Dial	ARF	19.3
145	93220	42	F	LHA	F	L	15 min	114	64	3	5	20	AB	Nil	ARF	11
146	91383	30	M	RFT	F	L	>20 min	66	19	0.8	10	15	AB	Nil	Nil	3.3
147	90429	70	F	RLE	F	L	>20 min	105	96	2.6	20	20	AB	Dial	ARF	4.45
148	40221	15	M	RFT	H	L	4 min	119	19	0.9	10	13	AB	Nil	Nil	3
149	40702	50	M	LFT	F	L	>20 min	132	39	1.2	10	20	AB	Nil	Nil	2
150	40718	22	M	LFT	F	L	>20 min	68	30	0.9	10	10	AB	Nil	Nil	2
151	40637	18	M	RTO	F	L	>20 min	101	20	1	10	10	AB	Nil	Nil	2
152	54827	45	M	LFT	F	L	12 min	103	60	1.3	10	10	AB	Fascio	C/N	12
153	56750	40	M	LFT	F	L	>20 min	96	102	3.2	20	25	AB	Nil	ARF	2.15
154	72688	18	M	LHA	F	L	>20 min	90	75	2.7	10	18	AB	Nil	Nil	2.3
155	72809	20	M	RFT	F	L	12 min	99	33	1.5	8	8	AB	Nil	Nil	5.15
156	72551	35	M	RFR	F	L	8 min	61	37	1.4	8	8	AB	Nil	Nil	1.4
157	82707	33	M	RFR	F	L	>20 min	62	40	1.3	10	15	AB	Nil	Nil	2.15
158	82547	40	M	LFT	F	L	5 min	92	34	1	10	15	AB	Nil	Nil	3
159	81813	60	F	RLE	F	L	8 min	108	52	1.8	8	8	AB	Dial	ARF	4.15
160	81549	47	M	RLE	F	L	>20 min	67	37	1.7	10	15	AB	Dial	ARF	10
161	82670	25	F	RAN	F	L	>20 min	132	104	4.3	10	15	AB	Nil	ARF	6
162	77488	27	F	RLE	F	L	>20 min	98	54	1.9	15	15	AB	Dial	ARF	8

163	82956	24	M	RTO	F	L	>20 min	68	22	0.8	10	10	AB	Nil	Nil	3
164	75220	35	M	RFT	F	L	>20 min	74	106	5	15	25	AB	Dial	ARF	5.3

KEY TO MASTER CHART

M- Male

F- Female

H- House

L-Local (Cellulitis/coagulopathy)

N- Neurological

AB-Antibiotics

Dial- Dialysis

Fascio- Fasciotomy

Vent- Ventilatory support

ARF- Acute Renal Failure

RF- Respiratory failure

C/N- Cellulitis /necrosis that needed debridement

R/LLE- Right/Left leg

R/LTH- Right/Left thigh

R/LFT- Right/Left foot

R/LAN- Right/Left ankle

R/LTO- Right/Left toe

R/LFR- Right/Left finger

R/LEL- Right/Left elbow

R/LSH- Right/Left Shoulder

R/LHA- Right/Left hand

R/LFA- Right/Left forearm